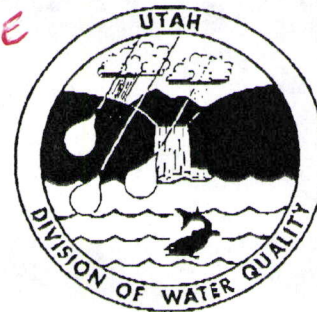




**TRANSMITTAL**  
STATE OF UTAH  
DIVISION OF WATER QUALITY  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
288 NORTH 1460 WEST  
P.O. BOX 144870  
SALT LAKE CITY, UTAH 84114-4870

m/023/003  
FILE



Telephone: (801) 538-6146

Facsimile: (801) 538-6016

☐ MAIL

DATE: Feb 23, 1998

☒ FAX

TO:

FROM: Larry Mize

Tom Munson

PHONE #:

538-6835

PHONE #:

We are pleased to provide the following to you:

ITEM:

Brush Wellman Monitoring Plan

FAX #:

359-3940

No. of Pages Including Cover Sheet: \_\_\_\_\_

☐

For your action

☐

For your information

☒

Per previous conversation on \_\_\_\_\_

☐

Per your/our correspondence dated \_\_\_\_\_

☐

Other \_\_\_\_\_

MESSAGE:

Tom, look over and call  
any ideas on plan would  
be appreciated

Larry

*Larry*  
*March 7*  
*m/023/003*

# BRUSHWELLMAN

ENGINEERED MATERIALS

Brush Wellman Inc.  
P.O. Box 815  
Delta, Utah 84624  
Phone 801/864-2701

DATE: May 23, 1997

Mr. Fred C. Pehrson, P.E., Manager  
Permits, Compliance & Monitoring Branch  
Utah Division of Water Quality  
288 North 1460 West  
P.O. Box 144870  
Salt Lake City, Utah 84114-4870



RE: Revised Ground Water Quality Impact Assessment Plan

Dear Mr. Pehrson:

Thank you for your letter of February 17, 1997 in which you responded to Brush Wellman, Inc.'s (BWI) Ground Water Quality Impact Assessment Plan (Plan) of December 30, 1996. We and our consultants, JBR Environmental, have reviewed your comments and we have modified the Plan to reflect the requested changes. Two copies of the revised plan are included for your review and final approval.

The materials selected for sampling will be exposed by current pre-stripping activities and subsequent mining activities later this summer. We plan to collect the samples for analysis at that time. We will then have the appropriate analyses performed and prepare a report of our findings for your consideration.

Please contact the undersigned or Mr. Bob Bayer of JBR Environmental with any questions that you may have.

Sincerely,

Greg Hawkins  
Mine Manager

cc: Don McMillan, Brush Wellman  
Bob Bayer, JBR Environmental Consultants, Inc.

m/023/003

**GROUND WATER QUALITY IMPACT ASSESSMENT PLAN  
BRUSH WELLMAN, INC., TOPAZ BERYLLIUM MINE**

**Introduction**

In a letter dated July 23, 1996 from Mr. Greg Hawkins of Brush Wellman, Inc. to Mr. Larry Mize of the Division of Water Quality, Brush Wellman asserted that the Topaz Beryllium mine is exempt from the Utah Ground Water Protection Regulations because the mine will not "...result in a discharge of pollutants that may move directly or indirectly into groundwater...." The letter then stated Brush Wellman's intention to support this assertion by preparing a plan for assessment of the potential impact to ground water quality by the open pits, stockpiled ore, and waste rock dumps at the mine. This document presents that plan.

**Proposed Sampling Plan**

Brush Wellman's extensive experience mining beryllium ores at the Topaz Beryllium mine has resulted in a thorough understanding of the distribution of beryllium in the ore deposits. The mining sequence for the deposits at the mine is selected so that both a low-grade and high grade deposit are developed and mined simultaneously. The ores from these deposits are then blended in separate stockpiles resulting in a low grade and a high grade stockpile. Ore from each stockpile is shipped to the mill in proportions corresponding to the beryllium concentration in each stockpile so that the beryllium concentration of the ore shipped to the Delta Mill meets the requirements established by the mill.

In addition to beryllium, trace elements (primarily metals), which represent potential ground water contaminants, are present in the ore and waste rock. The concentrations of these elements are variable in the deposits and may in part increase and decrease in correspondence with beryllium concentrations. Therefore, representative high grade and low grade open pits, the waste rock dumps derived from them, and the active high grade and low grade ore stockpiles are proposed for sampling as part of this investigation.

Two high grade open pits, Monitor #3 and Roadside/Fluro #3 and the waste rock dumps derived from mining them have been selected for sampling. Likewise, two low grade open pits, North Blue Chalk #2 and Section 16 #1 and their waste rock dumps are also proposed for sampling. The following types of waste rock samples are proposed to be taken from each pit or dump: unaltered

rhyolite, altered rhyolite, and waste tuff (from either above or below the ore zone). By sampling four separate pit/dumps, four samples of each waste rock type will be obtained. Samples will be collected randomly from either dumps or pit walls using a backhoe or a drill rig. Each sample will consist of a composite sample made up of at least three components.

The ore bodies at the topaz Beryllium mine are highly oxidized; therefore, selection of waste rock samples from either pit walls or waste rock dumps will be equally representative of waste rock and pit wall rocks in terms of overall rock chemistry. The locations of sampling points will be determined by Brush Wellman after taking into consideration accessibility to representative rock types and safety.

The active low grade ore stockpile, derived from and located adjacent to the Section 16#1 pit and the active high grade ore stockpile, derived from and located adjacent to the Roadside/Fluro #3 pit, will be also be sampled. Brush Wellman blends the ore in the stockpiles so the mill feed concentrations are relatively constant; therefore, the stockpiles can be considered homogeneous. Two representative three-component composite samples of the ore will be gathered from each stockpile, resulting in a total of four ore samples.

The size of each sample component will be approximately 15 pounds. The components of each sample will be placed into a single plastic bucket with a five to six gallon capacity resulting in a composite sample weighing approximately 45 pounds. The sample containers will be sealed and sent under chain of custody to SVL Analytical for thorough blending, sample preparation (crushing and aliquot separation), and analysis. An extra sample of each waste rock type (three samples) and one extra ore sample will be also collected and sent to the lab. These samples will be used in pre-testing the material for percolation to determine the extraction protocol to be used, as discussed below.

### Proposed Sample Analysis Plan

The proposed plan for assessment of the potential for impact to ground water quality by Brush Wellman Inc. s mining operations consists of assessment of the potential for leaching of contaminants from ore stockpiles, waste rock dumps, and open pit wall rocks. Two methods of analysis are proposed: direct testing of samples for leachable elements and acid-generating and neutralization tests (acid-base accounting - ABA). Most metals and other contaminants are mobile in acid conditions; therefore, if stockpiled ore,

wallrocks in open pits, or wasterock are acid-generating, acid rock drainage and leaching of metals may result.

Neither the ores or waste rocks at Brush Wellman's Topaz Beryllium mine are known to contain sulfide minerals.<sup>1</sup> Nevertheless, the Division has requested that Brush Wellman demonstrate that acid-generating sulfide minerals are indeed not present. ABA tests are performed by first performing static tests. If static tests suggest that material is or may be acid-generating, a variety of kinetic tests have been developed to confirm acid-generation potential and to evaluate the sensitivity of acid generation to pH and the rate of acid generation.

Static ABA tests include two components: determination of the neutralization potential (NP) and determination of the acidification potential (AP). The modified Sobek method will be used. NP is measured by acidification with hydrochloric acid and titration to pH 8.3 using sodium hydroxide. Two types of AP analyses are performed as part of static testing: one is based on total sulfur analyses and the other analyzes the various sulfur forms (sulfide, sulfate, and organic). Brush Wellman will analyze the samples using the latter AP method. This method involves determination of total sulfur by the LECO furnace and then using a sequential leaching procedure (with increasingly strong leaching agents) which is part of the modified Sobek method. The results of each test are expressed in the units tons of CaCO<sub>3</sub> / 1000 tons of material tested. If the NP/AP ratio is 3:1 or more, the sample will be considered non-acid-generating and no further testing is proposed. If the initial results indicate that the ore or waste rocks are acid-generating, a procedure for kinetic testing will be proposed.

Leachate testing is proposed to be performed using the meteoric water mobility procedure (MWMP) which was developed by the State of Nevada and is now being considered by the American Society for Testing Materials (ASTM) for adoption as a standard testing method for leachability of metals and other elements from ores and waste rock. This procedure has been selected because it best simulates field conditions believed to exist at Brush Wellman: leaching by rain water that results in a non-acid leachate. If the results of the ABA tests indicate that acid conditions do exist, an alternative procedure may be proposed for use during further testing.

The MWMP procedure calls for a single-pass column leach over a 24-hour period using a Type II reagent grade water (deionized water, etc). Five kilograms of the sample are prepared by crushing it to minus 2 inches. The

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<sup>1</sup> Sulfide minerals can, upon oxidation (as the result of exposure to air or oxygenated waters), result in acid drainage from mines, waste rock, or ore stockpiles.

sample is then placed in a six-inch diameter PVC column. Extraction fluid in a ratio of 1:1 by volume is applied to the column. Extraction fluid is applied in the following manner: "...the extraction fluid application rate [is adjusted] such that the number of milliliters of water applied to the column in a 24 hour period will be equal to the number of dry grams of mine rock sample in the column." Extraction is complete when the prescribed volume has passed through the column and has been collected. This extract is then filtered, appropriately preserved, and analyzed for the appropriate parameters. A complete description of the MWMP is provided in the Appendix.

If fine-grained samples prevent percolation of the necessary water volume in a 24-hour period, an alternate extraction procedure is used. The extra sample collected for each of the three waste rock types and of ore will be used in a preliminary test of column percolation. If this percolation test demonstrates that the procedure cannot be completed in a 24-hour period, the alternate extraction procedure to be used will be a modified bottled roll. This method calls for five kilograms of sample and five liters of Type II reagent grade water to be placed in vessel which is then rotated for a 24-hour period. The extract is then removed from the vessel and filtered prior to preservation and analysis.

Brush Wellman proposes that the extract samples from each of the rock samples be analyzed for fluoride, the metals and radionuclides for which Utah ground water quality standards have been established, as well as beryllium. The Division has requested that the extract also be analyzed for antimony and thallium. Although these metals are not associated with ore deposits of this type, Brush Wellman agrees to analyze the extract for these metals. Uranium has also been added to the list of analytes for the MWMP extract solutions at the Division's request. Table 1 lists these parameters.

Table 1. Proposed Analytical Parameters for Leachate Extract Analysis

Antimony  
Mercury  
Arsenic  
Selenium  
Barium  
Silver  
Beryllium  
Thallium  
Cadmium  
Uranium  
Chromium  
Zinc  
Copper  
Gross alpha particle activity  
Lead

Combined Radium-226 and Radium-228

The radionuclide analyses are proposed to be conducted sequentially. We propose that the radium analyses be performed on the extract for a given sample only if the gross alpha analysis for that sample exceeds the ground water quality standard for radium of 5 pCi/l. Since radium is an alpha emitter, it is unlikely that the radium standard will be exceeded if the gross alpha activity is less than the standard for radium. All sample extracts would be analyzed for uranium.

Brush Wellman proposes that the Utah ground water quality standards for the elements listed above be considered thresholds for evaluation of the results of the MWMP. If the standards are not exceeded in the MWMP extract, no further investigation would be warranted. Brush Wellman believes that the Topaz Beryllium mine should then be considered exempt from the ground water regulations since it will have been demonstrated that the mine activities will not ... result in discharge of pollutants that may move directly or indirectly into ground water. If one or more of the standards are exceeded or if the ABA tests demonstrate that some or all of the waste rock may be acid generating, Brush Wellman proposes to conduct additional testing and evaluation. The plan for such testing and evaluation would be developed using the initial test results for guidance in selecting any necessary additional sampling, supplemental laboratory analysis, or other means of evaluating potential ground water impact, including consideration of the site-specific geology and hydrogeology and geochemical evaluations.

Brush Wellman believes that the sampling and analytical plans described in the foregoing sections will provide a thorough and representative assessment of the potential for leaching of trace elements from ore and waste rock.

MONITOR PIT + 3 ANES AREA TUFF - MONITOR WATER YEAR ROUND  
OL LANE BONNEVILLE POND RETAIN WATER  
WT. - BRACKISH PIT NOT ACID  
WHITEIL GEOLOGIC ORE dips into  
RELATIVE ELEV. OF PITS THE WHITEIL TABLE 300'  
SALTS + TURBIDITY MINING ADDS TO GW.  
ALK + TURBIDITY 300-600 ABOVE GW  
SECONDARY STDS DEEP EXPLORATION HOLES HALL  
FISH SPRINGS 10 MILES COUNTRY WELL

NEVER RESPOND  
EXPOSED ORE IN PITS  
MINE -

ANACONDA PITS

BOTTOM OF PIT WATER  
WELL WATER

CLEANER  
WATER  
THAN

SILICATE DEPOSIT

200-425

TAILINGS POND  
DIV. OF RADIATIONS  
CLEAR PH 1-3

390-400 UPPER BENCH

MONITOR PIT

390.

475

125' FOOT ALTERED TUFF  
R40

= LIMESTONE

20 YEARS

600-900

INCHES/DAY ALL EVAPORATE

4 OR 5 BEFORE  
MINE

1 TO 2 FOOT DRY TUFF

LAYERING SELF MEND

PHENIX ON  
LAST PITS  
CONTRACT MAX CROFT  
DIV. OF RADIATION  
RESPONSE TESTING  
RADIATION